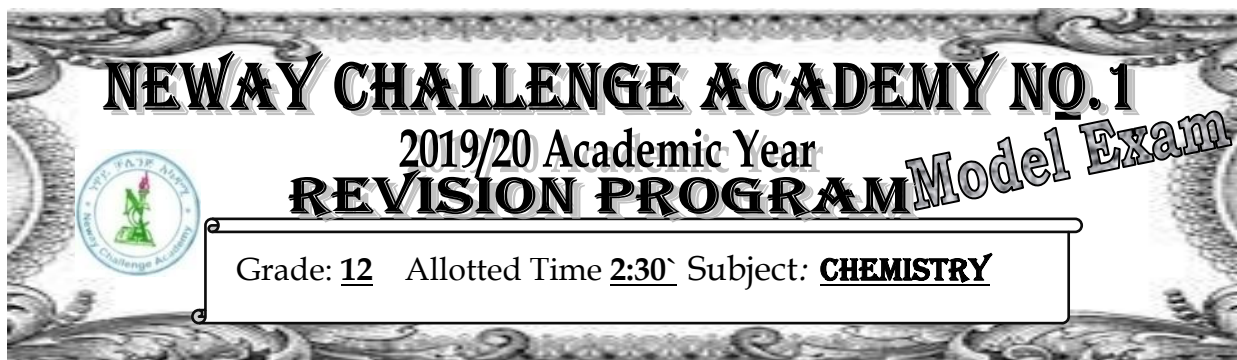




I. Choose the correct answer from the given alternatives.

- How many atoms are present in 22g of CO_2 ?
 A. 3.01×10^{23} B. 6.02×10^{23} C. 12.04×10^{23} D. 9.03×10^{23}
- How many significant figures are there in 4.03×10^{-9} ?
 A. 1 B. 2 C. 3 D. 9
- One mole of $(\text{NH}_4)_2\text{HPO}_4$ contains _____ moles of hydrogen atoms.
 A. 1 B. 5 C. 6 D. 9
- How many milligrams are in 0.2 decigrams?
 A. 20mg B. 2000mg C. 0.002mg D. 0.00002mg
- Which of the following is the right order of the steps of a scientific method?
 A. Performing experiments $\rightarrow$ formulating hypothesis $\rightarrow$ making observation
 B. Making observation $\rightarrow$ formulating hypothesis $\rightarrow$ performing experiments
 C. Making observation $\rightarrow$ Performing experiments $\rightarrow$ formulating hypothesis
 D. Formulating hypothesis $\rightarrow$ making observation $\rightarrow$ Performing experiments
- What is the total number of orbital associated with the principal quantum number, $n = 4$?
 A. 4 B. 8 C. 16 D. 32
- Which of the following is caused by poor calibration of instruments?
 A. Rondon error C. Average deviation
 B. Relative average deviation D. Systematic error
- A mono-atomic ion that has 20P^+ and $+2$ charge:
 A. Has 16P^+ s C. Is iso-electronic with Ar
 B. Has 18n^0 s D. Has the symbol Ar^{2+}
- Natural occurring Cu consists of ^{63}Cu and ^{65}Cu . What is the percentage abundance of ^{63}Cu , if the average mass of Cu is 63.5?
 A. 25 B. 33 C. 50 D. 75
- Which one of the following electromagnetic radiation has the longest wavelength?
 A. Microwaves B. X-rays C. Radio waves D. Gamma rays
- The energy required to remove an electron from an iron atom is $7.21 \times 10^{-19}\text{J}$. What is the maximum wavelength of light that can perform this?
 A. 250nm B. 276nm C. 289nm D. 300nm

12. Which of the following electron transition requires the smallest energy to be absorbed by the hydrogen atom?
A. From $n = 1$ to $n = 2$
B. From $n = 2$ to $n = 3$
C. From $n = 3$ to $n = 4$
D. From $n = 4$ to $n = 5$
13. For an electron that has quantum number, $n = 4$ and $m_l = 0$, which of the following is true?
A. Must have $n = 0$
B. Must have $l = 0$
C. Must have $m_s = +\frac{1}{2}$
D. May have $l = 0, 1, 2, 3$
14. For which of the following elements is Hund's rule used in writing the electron configuration?
A. Carbon
B. Boron
C. Beryllium
D. Lithium
15. Which of the following data gives the most precise measurement?
A. 5g
B. 5.0g
C. 5.00g
D. 5.000g
16. How many bonding and non-bonding electron pairs are found around the central atom in BF_3 molecule?
A. 1BP and 3LP
B. 2BP and 2LP
C. 3BP and 1 LP
D. 3BP and 0LP
17. sp^3d^2 hybridization is present in $[\text{CO}(\text{NH}_3)_6]^{3+}$ find its geometry?
A. Octahedral geometry
B. Square planar geometry
C. Tetragonal geometry
D. Tetrahedral geometry
18. Which of the following molecules does NOT have a permanent dipole moment?
A. SO_3
B. SO_2
C. H_2S
D. CS_2
19. Which one of the following violates the octet rule?
A. PCl_3
B. SO_2
C. H_2S
D. CS_2
20. What is the total number of electrons in the correct Lewis dot formula of the sulphite ion?
A. 8
B. 24
C. 26
D. 30
21. An electron has a spin quantum number, $m_s = +\frac{1}{2}$ and $m_l = +1$. In which of the following orbital will it NOT be present?
A. s-orbital
B. p-orbital
C. d-orbital
D. f-orbital
22. Which of the following hydrogen halide is most volatile?
A. HF
B. HCl
C. HBr
D. HI
23. Which of the following species is paramagnetic?
A. O_2^-
B. CN^-
C. CO
D. NO^-
24. Which electron is most electro negative?
A. sp^3 hybridized
B. sp hybridized
C. sp^2 hybridized
D. none of these
25. How many sigma and Pi bonds are present in toluene?
A. 3π and 8 sigma bonds
B. 3π and 16 sigma bonds
C. 3π and 10 sigma bonds
D. 6π and 3 sigma bonds
26. Carbon and chlorine form a series of compounds: CH_3Cl , CH_2Cl_2 , CHCl_3 , CCl_4 . Which of these will be polar?
A. CCl_4 only
B. CH_3Cl and CHCl_3 only
C. CH_3Cl , CH_2Cl_2 and CHCl_3 only
D. CH_3Cl , CH_2Cl_2 , CHCl_3 and CCl_4

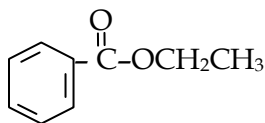
27. Which of the following molecules would you expect to be non planar?
 A. CH₄ B. BCl₃ C. XeF₄ D. HCHO
28. Of the following the most polar bond is:
 A. P – Cl B. Si – F C. S – O D. C – N
29. Four elements T, E, S and F have atomic number Z-1, Z, Z+1 and Z + 2, respectively. If Z = 9, then the bond between which pair of elements will be ionic?
 A. T and S B. S and F C. E and F D. E and S
30. Which of the following ionic compounds has the smallest melting point?
 A. LiF B. CSI C. NaF D. LiI
31. NF₃, BF₃ and ClF₃ all have molecular formula of the type XF₃. Which molecules have trigonal pyramidal molecular geometry?
 A. NF₃ and BF₃ B. BF₃ and ClF₃ C. NF₃ and ClF₃ D. NF₃
32. What type of hybridization is used by sulphur in SF₆?
 A. SP² B. SP³d C. SP³ D. SP³d²
33. The rate constant for the decomposition of gaseous CH₃CHF₂ is $7.9 \times 10^{-7}\text{S}^{-1}$ at 429°C and $1.7 \times 10^{-4}\text{S}^{-1}$ at 522°C.
 $\text{CH}_3\text{CHF}_{2(\text{g})} \rightarrow \text{CH}_2\text{CHF}_{(\text{g})} + \text{HF}_{(\text{g})}$
 The activation energy for this reaction is:
 A. $340 \times 10^{-5}\text{S}^{-1}$ B. 270KJmol⁻¹ C. 135KJmol⁻¹ D. None
34. In a zero-order reaction for every 10° rise of temperature, the rate is doubled. If the temperature is increased from 10°C to 100°C, the rate of the reaction will become:
 A. 64times B. 128times C. 256times D. 512times
35. The following data were obtained during the first order decomposition of
 $2\text{A}_{(\text{g})} \rightarrow \text{B}_{(\text{g})} + \text{C}_{(\text{s})}$ at a constant volume and at a particular temperature.

No	Time	Total pressure/Pa
1	At the end of 10min	300
2	After completion	200

- The rate constant in min⁻¹ is:
 A. 69.3 B. 0.0693 C. 6.93×10^{-4} D. 6.93
36. Formation of an activated complex is explained by:
 A. Molecular kinetic theory C. Transition-state theory
 B. Valence-bond theory D. Collision theory
37. N₂O₅ dissolve in CCl₄ decomposes by a first order reaction in to N₂O₄ and O₂. How many seconds will it take for the concentration to drop from 0.1M to 0.05M if the rate constant at the reaction temperature is $6.93 \times 10^{-4}\text{S}^{-1}$?
 A. 200 B. 18000 C. 1500 D. 1000

38. For a reaction to shift towards the product direction, which of the following condition holds true?
 A. $Q_C = K_C$ B. $Q_C < K_C$ C. $Q_C > K_C$ D. $Q_C = K_C$
39. For the reaction:
 $C_{(s)} + CO_{2(g)} \rightleftharpoons 2CO_{(g)}$
 The partial pressures of CO_2 and CO are 2atm and 4atm respectively at equilibrium. What is the value of K_P for this reaction?
 A. 0.5atm B. 4atm C. 8atm D. 32atm
40. The equilibrium partial pressures of SO_2 , O_2 and SO_3 are 0.1atm, 0.25atm and 0.5atm respectively. The equilibrium constant for the reaction below is:
 $SO_{3(g)} \rightleftharpoons SO_{2(g)} + \frac{1}{2}O_{2(g)}$
 A. 0.1 B. 10 C. 0.05 D. 20
41. Which of the following is likely to happen when pressure is applied to the following system at equilibrium:
 $H_2O_{(s)} \rightleftharpoons H_2O_{(l)}$
 A. More H_2O will be formed C. H_2O will evaporate
 B. More ice will be formed D. No change occurs
42. What will happen when CaO is added to the following reaction at equilibrium?
 $CaCO_{3(s)} \rightleftharpoons CaO_{(s)} + CO_{2(g)}$
 A. No change occurs C. Reaction shifts in the forward direction
 B. More $CaCO_3$ is formed D. Total pressure increases
43. The equilibrium constant for the reaction:
 $3H_{2(g)} + CO_{(g)} \rightleftharpoons CH_{4(g)} + H_2O_{(g)}$; is 3.93 at 1200K. A system at equilibrium has: $[CO] = 0.1522M$, $[H_2O] = 0.478M$. What is the $[CH_4]$?
 A. 0.0421 B. 0.0452 C. 0.0481 D. 0.0510
44. Consider the following reaction:
 $2NO_{(g)} + Cl_{2(g)} \rightleftharpoons 2NOCl_{(g)}$, $\Delta H = -78KJ$. What conditions of temperature and pressure will produce the highest yield of $NOCl$ at equilibrium?
 A. High temperature, high pressure C. low temperature, high pressure
 B. High temperature, low pressure D. low temperature, low pressure
45. Which of the following reactions has equal values of K_C and K_P ?
 A. $CO_{(g)} + 2H_{2(g)} \rightleftharpoons CH_3OH_{(g)}$ C. $H_{2(g)} + CO_{2(g)} \rightleftharpoons H_2O_{(g)} + CO_{(g)}$
 B. $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ D. $Ni_{(s)} + 4CO_{(g)} \rightleftharpoons Ni(CO)_{4(g)}$
46. Which of the following organic molecules has the highest water solubility?
 A. $HOOCCH_2COOH$ C. $HOOCCH_2CH_2COOH$
 B. $CH_3CH_2CH_2COOH$ D. $CH_3CH_2CH_2CH_2COOH$

47. What is the name of the following compound?

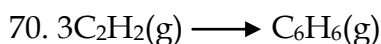


- A. Benzoate ester
B. Ethyl benzoate
C. Phenyl butyrate
D. Ethyl benzyl Ketone
48. What is the name of a base-promoted ester hydrolysis reaction?
A. Acylation B. Esterification C. Saponification D. Condensation
49. The important difference between oils and fats is that:
A. Oils are liquid but fats are solid at room temperature
B. Oils are solid while fats are liquid at room temperature
C. Oils contain saturated acids where as fats contain unsaturated acids
D. Oils are insoluble in water but fats are soluble in water
50. The structure for α -methyl hexanoic acid is:
A. $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$ C. $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CHOOH}$
B. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}(\text{CH}_3)\text{COOH}$ D. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{COOH}$
51. Low concentration of oxygen in the blood and tissues of people living at high altitude is due to _____.
A. low temperature
B. low atmospheric pressure
C. high atmospheric pressure
D. both low temperature and high atmospheric pressure
52. Which of the following aqueous solutions should have the highest boiling point?
A. 1.0 M NaOH B. 1.0 M Na_2SO_4 C. 1.0 M NH_4NO_3 D. 1.0 M KNO_3
53. In comparison to a 0.01 M solution of glucose, the depression in freezing point of a 0.01 M MgCl_2 solution is _____.
A. the same B. about twice C. about three times D. about six times
54. The value of Henry's constant K_H is _____.
A. greater for gases with higher solubility. C. constant for all gases.
B. greater for gases with lower solubility. D. not related to the solubility of gases.
- Cone. H_2SO_4 is 98 % H_2SO_4 by mass has $d = 1.84 \text{ g cm}^{-3}$. Volume of acid required to make one litre of 0.1 M H_2SO_4 is
A. 5.55 Ml B. 10 mL C. 20 mL D. 30 mL
55. Cone. H_2SO_4 is 98 % H_2SO_4 by mass has $d = 1.84 \text{ g cm}^{-3}$. Volume of acid required to make one litre of 0.1 M H_2SO_4 is
A. 5.55 Ml B. 10 mL C. 20 mL D. 30 mL
56. What is mole fraction of solute in 1.00 m aqueous solution?
A. 0.0354 B. 0.0177 C. 0.177 D. 1.770

57. Which of the following is incorrect for an ideal solution?
 A. $\Delta H_{\text{mix}} = 0$ C. $\Delta P = P_{\text{obs}} - P_{\text{calculated}} = 0$
 B. $\Delta V_{\text{mix}} = 0$ D. $\Delta G_{\text{mix}} = 0$
58. Which has the highest freezing point?
 A. 1 M glucose B. 1 M NaCl C. 1 M CaCl_2 D. 1 M AlF_3
59. Mole fraction of glycerine, $\text{C}_3\text{H}_5(\text{OH})_3$, in solution containing 36 g of water and 46 g of glycerine is
 A. 0.46 B. 0.40 C. 0.20 D. 0.36
60. People add sodium chloride to water while boiling eggs. This is to
 A. decrease the boiling point. C. prevent the breaking of eggs.
 B. increase the boiling point. D. make eggs tasty.
61. The van't Hoff factor (i) accounts for
 A. degree of solubilisation of solute. C. the extent of dissolution of solute.
 B. the extent of dissociation of solute. D. the degree of decomposition of solution.
62. What are spectator ions in ionic equation expression reaction of MgCl_2 and K_2CO_3 ?
 A. Mg^{2+} & CO_3^{2-} B. Mg^{2+} & 2K^+ C. 2K^+ & CO_3^{2-} D. 2K^+ & 2Cl^-
63. W/c one of the following is not an indication of stronger base?
 A. Larger pH value C. Larger percent dissociation
 B. Larger pOH value D. Larger K_b value
64. A substance that is capable of acting as both an acid and a base is:
 A. amphiprotic B. diprotic C. conjugated D. binary acid-base
65. When sodium acetate is added to an aqueous solution of acetic acid, what happens to pH of solution?
 A. increases B. remains constant C. decreases D. may increase or decrease
66. Which of the following is a component of acid buffer solution?
 A. Strong base & its conjugate acid C. Weak acid & its conjugate base
 B. Weak base and weak acid D. Strong acid & its conjugate base
67. W/c of the following is Lewis base?
 A. H^+ B. BF_3 C. PF_5 D. F^-
68. Bromocresol green indicator ($K_{\text{In}} = 1.0 \times 10^{-4}$) shows yellow and blue color for acidic and basic solution respectively. If pH of solution is 6 what color obtained with this indicator?
 A. Blue B. Orange C. Yellow D. Red
69. In which direction will the following equilibrium shift if a solution of CH_3COONa is added?

$$\text{CH}_3\text{COOH}_{(\text{aq})} \rightleftharpoons \text{CH}_3\text{COO}^-_{(\text{aq})} + \text{H}_3\text{O}^+_{(\text{aq})}$$

 A. The equilibrium shifts to the right.
 B. No change
 C. The equilibrium shifts to the left
 D. Cannot be predicted

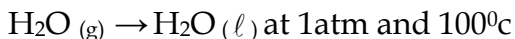


What is the standard enthalpy change, ΔH° , for the reaction represented above?

(ΔH°_f of $\text{C}_2\text{H}_2(\text{g})$ is 230 kJ mol^{-1} ; ΔH°_f of $\text{C}_6\text{H}_6(\text{g})$ is 83 kJ mol^{-1})

- A. -607 kJ B. -147 kJ C. -19 kJ D. $+19 \text{ kJ}$ E. $+773 \text{ kJ}$

71. Which one of the following is TRUE for the process?



- A. $\Delta H < 0$ and $\Delta S = 0$ C. $\Delta H < 0$ and $\Delta S < 0$
 B. $\Delta H > 0$ and $\Delta S > 0$ D. $\Delta H < 0$ and $\Delta S > 0$

72. Which one of the following is not a state function?

- A. Work C. Enthalpy
 B. Internal energy D. Gibbs free energy

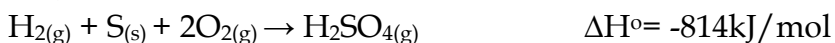
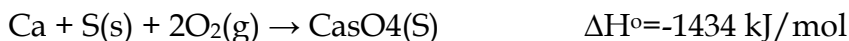
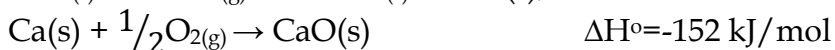
73. Which change in a sample of water is accompanied by the greatest increase in entropy?

- A. $\text{H}_2\text{O}(\ell)$ at 100°C is changed to $\text{H}_2\text{O}(\text{g})$ at 200°C
 B. $\text{H}_2\text{O}(\text{g})$ at 100°C is changed to $\text{H}_2\text{O}(\text{g})$ at 200°C
 C. $\text{H}_2\text{O}(\text{s})$ at -100°C is changed to $\text{H}_2\text{O}(\text{g})$ at 0°C
 D. $\text{H}_2\text{O}(\text{s})$ at -100°C is changed to $\text{H}_2\text{O}(\ell)$ at 0°C

74. Which of the following processes would you expect to be spontaneous?

- A. $\Delta S_{\text{surr}} > 0$, $\Delta S_{\text{sys}} > 0$ C. $\Delta S_{\text{surr}} > 0$, $\Delta S_{\text{sys}} < 0$
 B. $\Delta S_{\text{univ}} < 0$, $\Delta S_{\text{sys}} > 0$ D. $\Delta S_{\text{surr}} < 0$

75. How much heat will be evolved if 56.08 g of calcium oxide reacts with H_2SO_4 according to the following reaction?

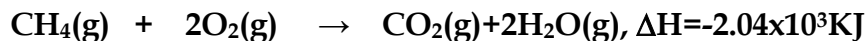


- A. -2960 kJ B. -754 kJ C. -10744 kJ D. 754 kJ

76. Identify the reaction that does NOT undergo spontaneously:

- A. $2\text{O}_3(\text{g}) \rightarrow 3\text{O}_2(\text{g})$ [$\Delta G < 0$ at all temperatures.]
 B. $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$ [$\Delta G < 0$ at low temperatures]
 C. $2\text{C}_{(\text{graphite})} + 2\text{H}_2(\text{g}) \rightarrow \text{C}_2\text{H}_4(\text{g})$ [$\Delta G = 0$ at standard temperature]
 D. $\text{Zn}(\text{s}) + \text{Cu}^{2+}(\text{aq}) \rightleftharpoons \text{Cu}(\text{s})$ [$\Delta G = 0$ at standard temperature]

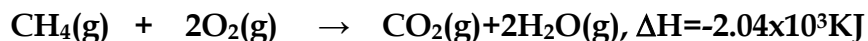
77. Consider the following gaseous reaction at 25°C



Which energy change would occur if 3.2 moles of CH_4 is completely combusted?

- A. $2.57 \times 10^3 \text{kJ}$ will be released.
- B. $2.57 \times 10^3 \text{kJ}$ will be absorbed.
- C. $6.43 \times 10^3 \text{kJ}$ will be released.
- D. $6.43 \times 10^3 \text{kJ}$ will be absorbed.

78. Consider the following gaseous reaction at 25°C



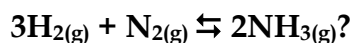
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- C. $6.43 \times 10^3 \text{kJ}$ will be released.
- D. $6.43 \times 10^3 \text{kJ}$ will be absorbed.

79. What is the change in internal energy, ΔE of a system if it absorbs 600KJ of heat from the surrounding and does 550KJ of work by the surroundings?

- A. +1150KJ
- B. -1150KJ
- C. +50KJ
- D. -50KJ

80. Given the reaction $\text{NH}_3(\text{g}) \rightleftharpoons 1/2 \text{N}_2(\text{g}) + 3/2 \text{H}_2(\text{g}), \Delta H = +45.9 \text{KJ/mol}$. What is the value of change of enthalpy for the reaction



- A. 91.8KJ/mol
- B. -91.8KJ/mol
- C. -45.9KJ/mol
- D. 45.9KJ/mol